Interoffice Memo

To: File
From: Valorie White, Project Manager
Date: August 8, 2012
Subject: State Revolving Fund (SRF) Project No. 5488-01
Ottawa County and Allendale Charter Township
Green Project Reserve (GPR) Qualifying Costs

In the Part III Application for the above-referenced project, the accompanying bid information was used to determine the final qualifying GPR amounts to be included in the Order of Approval package.

It has been determined that all the construction costs are eligible for inclusion in the GPR qualification. This results in a GPR total of $2,325,122.

Based on information provided by Fleis and Vanderbrink, the installation of anaerobic digesters will result is a 54 percent energy reduction, while replacing the current aerators with lagoon circulators will reduce energy consumption by 92 percent. Together these upgrades will produce a savings of approximately $28,200 annually.

Attached is a copy of the GPR documentation. The total construction costs for this project is $2,325,122, and the percentage of green construction is 100%. Since the SRF loan amount is $2,680,000, the total green cost (construction and non-construction) is $2,680,000 x 1.00 = $2,680,000.

Currently 50 percent of the GPR eligible cost qualifies for 'principle forgiveness', resulting in $2,680,000 x .50 = 1,340,000.

Please note that the eligibility of the GPR items was initially presented as a categorical case in July 2011, and updated in January 2012. This documentation was reviewed and approved by Keith Zahn of the Grand Rapids district office, Water Resources Division, on July 29, 2011 and February 1, 2012.

White, Valorie (DEQ)

From: Zahn, Keith (DEQ)
Sent: Wednesday, February 01, 2012 9:54 AM
To: White, Valorie (DEQ)
Subject: RE: Allendale GPR business case

Valorie,

From a treatment perspective, the proposal is acceptable. But I am not able to confirm (or refute) the energy savings.

Keith Zahn, P.E.
Water Resources Division
616-356-0244

From: White, Valorie (DEQ)
Sent: Wednesday, February 01, 2012 7:37 AM
To: Zahn, Keith (DEQ)
Subject: RE: Allendale GPR business case

Keith,

Here is a copy of the revised GPR business case that they sent me. Basically they switched from using solar aerators to using a new product called a Gridbee which is equipped with a small 120V motor. They claim that it still would provide roughly 92% energy efficiencies.

Valorie White

From: Zahn, Keith (DEQ)
Sent: Wednesday, February 01, 2012 7:04 AM
To: White, Valorie (DEQ)
Subject: RE: Allendale GPR business case

Valorie,

I have not seen this document.

Keith Zahn, P.E.
Water Resources Division
616-356-0244

From: White, Valorie (DEQ)
Sent: Tuesday, January 31, 2012 8:38 AM
To: Zahn, Keith (DEQ)
Subject: Allendale GPR business case

Keith,

I just wanted to double check and make sure Allendale sent you a copy of the revised green project reserve business case and to ask if you have any review comments on it. Let me know. Thanks.

Valorie White
Project Manager
DEQ RMD
Revolving Loan Section
Phone: (517) 335-7267
Fax: (517) 335-0743

White, Valorie (DEQ)

From: Zahn, Keith (DNRE)
Sent: Friday, July 29, 2011 6:51 AM
To: Jansma, Wendy (DNRE); White, Valorie (DNRE)
Subject: FW: Allendale Twp Green Business Case
Attachments: 807870 ACT Green Project Reserve 7-22-2011.pdf

I have reviewed the energy savings calculations and am in agreement with the conclusions.

Keith Zahn, P.E.
Water Resources Division
616-356-0244

From: Saldivia, Luis (DNRE)
Sent: Thursday, July 28, 2011 10:28 AM
To: Zahn, Keith (DNRE)
Cc: Worm, Michael (DNRE)
Subject: FW: Allendale Twp Green Business Case

Keith:

FYI. I will be replying to Wendy and I will copy you with my response. Thanks.

From: Jansma, Wendy (DNRE)
Sent: Thursday, July 28, 2011 8:25 AM
To: Saldivia, Luis (DNRE)
Cc: White, Valorie (DNRE)
Subject: Allendale Twp Green Business Case

Good Morning, Luis. Would you please confirm that review of the Allendale Twp green business case previously submitted by Valorie White is under way and let us know who is doing the review. Attached is the latest revision, which is significantly different from the prior version. We need District review done soon. We are required by EPA to post the green business cases, along with our required public hearing notice next week and need to know whether or not the District concurs with the energy savings calculations to qualify this project as green with additional subsidy for funding. Your prompt assistance will be very much appreciated.

Allendale Charter Township, Ottawa County
SRF Project No. 5488-01
Summary of Components Qualifying for Green Project Reserve
Update January 2012

Summary

The Allendale wastewater treatment plant (WWTP) has received odor complaints and the odors have been traced to sludge handling and digestion processing practices. Two process changes are recommended in order to minimize odors from sludge. First, anaerobic digesters are being considered to replace aerated digesters. Second, lagoon circulators are proposed to replace floating aspirating aerators currently in use in the sludge holding lagoons.

Loan amount[1]	$2,323,419
Green Project Reserve amount[2]	$2,323,419
Annual energy savings amount	$28,200

Background

The Allendale WWTP serves Allendale Township including Grand Valley State University. The plant has a rated capacity of 1.6 mgd. Plant processes include screening, grit removal, primary clarification, RBC aeration, secondary clarification, chlorination and dechlorination. Solids processes include aerated sludge holding tanks followed by sludge holding lagoons.

Classification

The anaerobic digestion portion of the project qualifies under 3.2-2 Energy Efficient Categorical Projects that result in a 20% energy savings.

The lagoon circulators qualify under 3.2-1 Energy Efficient Renewable Energy Categorical Project. The circulators will replace grid-powered floating aspirating aerators, so they also qualify under 3.2-2 Energy Efficient Categorical Projects that result in a 20% energy savings.

Confirmation

Anaerobic Digesters

The plant currently has two aerated sludge holding tanks that are utilized as aerobic digesters. The aeration system blowers are powered by 25 hp motors that nominally operate constantly. Each of the two proposed high-rate anaerobic digesters will be equipped with a 15 hp mixing pump and a 5 hp heat exchanger recirculation pump. The hydronic heat loop will contain a 3 hp circulation pump.

Continuous mixed, high-rate digesters have been employed for decades. The proposed high-rate digester will be hydraulically mixed and the mixing system operates *intermittently*, typically 50% of the time or less while achieving excellent digestion. The SCADA system will coordinate the feed, mixing and heating operation of the digester, and as such it is possible to run the heat circulation and hydronic loop pumps only when there is a heat demand. For example, the heating system will operate 24 hours per day in February, and approximately 2 hours per day in July. The heat system pumps will operate an estimated 60% of the time on an annual basis.

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[1] Excludes item not eligible for SRF loan.
[2] Refer to attached spreadsheets for cost detail.

The anaerobic digester project incorporates several additional features that contribute to energy efficiency, including:

- Insulation on above-grade tank walls and covers to minimize sludge heat loss.
- Motorized valve actuators on primary clarifier sludge lines that are controlled by the SCADA system. The valves open to feed the digester, multiple (3x, 4x or 6x) feedings each day maximizes the sludge concentration by reducing rat holing. The largest heat load in anaerobic digestion is the feed sludge.
- A floating "gasholder" cover will be installed on one tank. Storage of the biogas enables utilization in a boiler, thereby offsetting the need for utility gas to heat the digester and potentially space heating with surplus heat.
- Fine influent screening, effective grit removal and use of chopper pumps in the hydraulic mixing system contribute to minimizing digester cleaning maintenance. Digesters are cleaned when grit accumulates on the floor and when a mat of hair/grease/foam collects on the liquid surface. Good screening and grit collection minimizes grit accumulation in the digester, and a scum buster nozzle breaks up and chopper pumps homogenize the floating layer. Digester startup typically includes filling the tank with plant effluent and heating to 98°F before introducing sludge. Heating each tank of water consumes approximately 12,000 kW·hr of energy. The traditional annual maintenance may be reduced to every other year with effective screening and scum controls. The annual energy savings estimate is:

  Savings

  12,000 kW·hr/tank x 2 tanks x 1/2 year cleaning = 12,000 kW·hr/yr
  12,000 kW·hr/yr x $0.10 kW·hr = $1,200/year

- Boilers equipped to preferentially burn biogas (a renewable energy) over utility natural gas. Typically utility gas would be used only during startup and during peak heat demand periods when stored biogas is depleted.
- The plant's SCADA system will be modified to operate the feeding and heating processes on the digester. Both processes are controlled by the SCADA in order to implement intermittent operation of motors that run the pumps that hydraulically mix the digester, the sludge recirculation and hydronic loop pumps that maintain the digester temperature.
- Potential to install combined heat and power using biogas as the fuel source.

The annual energy savings estimate of the proposed project over the existing system is:

Existing
Blowers: 2 motors x 25 hp x 0.7457 kW/hp x 24 hr/day x 365 day/yr = 326,600 kW·hr/yr

Proposed
Mixing system: 2 motors x 15 hp x 0.7457 kW/hp x 0.5 x 24 hr/day x 365 day/yr = 98,000 kW·hr/yr
Heat circulation: 2 motors x 5 hp x 0.7457 kW/hp x 0.6 x 24 hr/day x 365 day/yr = 39,200 kW·hr/yr
Hydronic loop: 1 motor x 3 hp x 0.7457 kW/hp x 0.6 x 24 hr/day x 365 day/yr = 11,700 kW·hr/yr

Savings

(326,000-(98,000+39,200+11,700))/326,000 x 100 = 54% energy savings
(98,000+39,200+11,700) kW·hr/yr x $0.10/ kW·hr = $17,700/year

The energy savings resulting from conversion of the aerobic holding tanks into high-rate, intermittently mixed anaerobic digesters is approximately $18,900/year. The estimated 54% energy savings qualifies the project as categorically eligible.

Lagoon circulators

The lagoons have been utilized for sludge storage, and in the past decade one 10-hp and one 7.5-hp aerators have been operated for oxygen transfer and mixing. Following the improvements project, anaerobically digested sludge will be sent to the storage lagoons.

The lagoon circulators will effectively create an "odor cap" through stratification with higher dissolved oxygen (DO) concentrations at the surface, and anaerobic conditions at the bottom of the lagoons. The lagoon circulators bring water from facultative layers (near the middle of the lagoon) up to the surface where oxygen can be imparted, as illustrated in Figure 1.

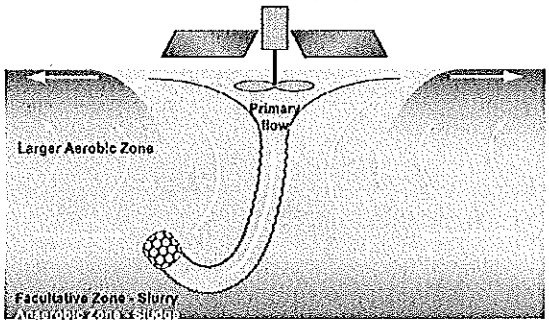

Figure 1 – Solar Powered Lagoon Circulator Flow Pattern Diagram[3]

Each of the aerators will be supplemented by lagoon circulators. The circulators utilize a very small motor, so significant electrical energy savings is anticipated compared to operating the existing aerators. The existing aspirating aerators will remain installed for emergency back-up. The annual energy savings estimate is:

Existing
Aerators: (7.5+10) hp x 0.7457 kW/hp x 24 hr/day x 365 day/yr = 114,300 kW·hr/yr

Proposed
Lagoon circulator system: 2 units x 0.5 hp x 0.7457 kW/hp x 24 hr/day x 365 day/yr = 8,800 kW·hr/yr

Savings

(114,300-8,800)/114,300 x 100 = 92% energy savings
(114,300-8,800) kW·hr/yr x $0.10/ kW·hr = $10,500/year

Conclusion

The existing sludge processing system produces odors. Odors can be controlled and significant energy savings realized by converting the process to a high-rate anaerobic digestion system and converting the sludge storage lagoons from aerated to anaerobic with an odor cap.

[3] Solarbee, Inc. Village of St. Henry Wastewater Treatment Plant Cuts Mechanical Aeration Time by 60% with Solar-Powered Circulation Technology. www.solarbee.com